DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the base station device for bidirectional wireless packet communications. In the wireless packet communication system which comprises a base transceiver station where this invention uses a wired network as backbone, and the subordinate's wireless subscriber station (radio terminal), When [from the uphill direction data communication and the base transceiver station from a radio terminal to a base transceiver station to a radio terminal] getting down and performing direction data communication, it can use in order to enable a guarantee of fixed communication quality to the data communications of up-and-down both directions.
[0002]
[Description of the Prior Art]There is a method to which expansion of the radio access control in a radio communications system which the IEEE802.11 committee specifies as the conventional preferential control method for offering a fixed guarantee about communication quality, such as maximum delay time and minimum band width, was carried out. In the system specified in the IEEE802.11 committee, control as shown in drawing 8 is performed. In this system, Carrying out carrier sensing so that the collision in which two or more radio terminals are packets may not arise. Data. CSMA/CA (Carrier.) which transmits DCF (Distributed Coordination Function: distributed control procedure) and the base transceiver station using SenseMultiple Access with Collision Avoidance polling. PCF (Point Coordinated Function: concentrated control procedure) which uses and performs access control intensively is specified as an access control method.
[0003]The DCF period (period which performs DCF control), and the PCF period (period which performs PCF control) are separated in time, and two kinds of control are repeated by turns the fixed cycle T1. The example in the case of performing radio using this system among one a base transceiver station and three radio terminals of a subordinate (1, 2, 3) is shown in drawing 9, drawing 10, and drawing 11. The state when PCF is used as radio access control is shown by this example.
[0004]As shown in drawing 9, a radio terminal (1) will transmit and receive data, if a polling frame is received. Next, a base transceiver station performs simultaneously ACK frame transmission addressed to a radio terminal (1) accompanying the polling to a radio terminal (2), and reception of the data from a radio terminal (1). The polled radio terminal (2) continues at reception of a polling frame, and transmits data to a subordinate base transceiver station.
[0005]Then, a radio terminal (3), a radio terminal (1), and ... and turn bowl. The drilled radio terminal starts transmission of data immediately after reception of a polling frame. That is, a subordinate's radio terminal cannot transmit data, unless it is polled from a subordinate base transceiver station. For this reason, the base transceiver station can carry out central control of the data transmission of a subordinate's radio terminal thoroughly by polling.
[0006]Therefore, control of PCF is suitable for guaranteeing fixed communication quality

like the guarantee of maximum delay time, or the guarantee of minimum band width. For this reason, the communication quality guarantee in the system based on the conventional IEEE802.11 standard has been performed by the scheduling which used PCF. The conventional communication quality control using PCF is performed as shown in drawing 10 and drawing 11.

[0007]In the example of drawing 10, the case where the radio terminal which has video stream data transmits and receives data in a PCF period is assumed. The base transceiver station which has said radio terminal in a subordinate guarantees a time delay to the data transmission of a radio terminal by managing a polling list. In the example of drawing 11, the zone demanded is guaranteed by performing scheduling in consideration of the state of a radio channel to several minimum band guarantee type data flow from which the demand to a radio terminal from a base transceiver station differs.

[0008]In the example of drawing 10, a base transceiver station carries out scheduling of the polling to the radio terminal (video terminal) which transmits video stream data, and enables video stream transmission of each radio terminal. It is a base transceiver station at the PCF start time, and it adds all the video terminals to a polling list. And a video terminal (1-3) is polled in order by RAUNDOROBIN. At this time, the data of addressing to a video terminal (1) which the base transceiver station holds at cue is transmitted with the polling information on a video terminal (1).

[0009]That is, the control shown in drawing 10 carries out scheduling of the data transmitter meeting of the going-up direction from a radio terminal to a base transceiver station. For this reason, it is necessary to wait for the opportunity of the polling to a radio terminal from a base transceiver station which it got down and carried out scheduling a priori about the data transmission of the direction. On the other hand, the case where a base transceiver station carries out by guaranteeing a zone to a subordinate's radio terminal (1-3) which gets down and is different in the data transmission of a direction, respectively is shown by the example of drawing 11. In the example of drawing 11, it assumes that the state of the communications channel from a base transceiver station to a radio terminal (2) is bad, and the state of the communications channel from a base transceiver station to a radio terminal (1, 3) is good.

[0010]In this example, a base transceiver station manages the time (start_time(i)) which should transmit a packet to the i-th flow at the time of scheduling, and the present time (current_time), The flow which has the minimum time (start_time(i)) in all the flows is transmitted by top priority. That is, it is transmitted in an order from the packet addressed to a radio terminal which has the minimum time (start_time(i)).

[0011]Usually, immediately after transmitting the packet to a radio terminal (1), a packet is transmitted to the flow to the radio terminal (2) in which time (start_time(i)) becomes the minimum. However, since the channel state of a radio terminal (2) is judged to be bad in the channel estimate before transmission in the example of drawing 11, the packet of the flow to a radio terminal (3) with small time (start_time(i)) is transmitted to the next of the flow of a radio terminal (2).

[0012]That is, by the method of drawing 11, in the PCF period, a base transceiver station does not perform polling to a radio terminal, but in order to guarantee a zone to the data flow addressed to a radio terminal, it gets down and it is performing only scheduling to direction data from a base transceiver station to a radio terminal.

[0013]

[Problem(s) to be Solved by the Invention]When adopting the method shown in drawing 10, it is necessary to wait for the opportunity of the polling which faces to a radio terminal from a base transceiver station and which it got down and carried out scheduling a priori about the data transmission of the direction. For this reason, if the number of the radio terminals to poll increases, a time delay will also increase, it gets down from a base transceiver station as a result, and a guarantee of the communication quality over direction data transmission becomes difficult.

[0014]On the other hand, in the method shown in drawing 11, since it gets down and scheduling only of the data of a direction is carried out, to the data of the uphill direction which goes to a base transceiver station, fixed communication quality cannot be guaranteed from a radio terminal. In the above base station devices for bidirectional wireless packet communications, an object of this invention is to enable a guarantee of fixed communication quality to the data communications of going up and the both directions from which it gets down.

[0015]

[Means for Solving the Problem]A base station device for bidirectional wireless packet communications of claim 1 this invention, A radio communications system containing a base transceiver station from which data is relayed between a wire net and a wireless communication network, and a radio terminal which is in said base transceiver station and a dependency, and carries out wireless packet communication between said base transceiver stations is characterized by comprising:

The uphill direction scheduling section which manages a data transmission order of a radio terminal that said base transceiver station raised a Request to Send of data.

Data which arrived from a wire net is distributed on a transmission buffer according to a priority, While it has a data transmission part which transmits data taken out from said transmission buffer and said base transceiver station controls data transmission addressed to a radio terminal, and data transmission of a radio terminal by polling, Data transmission is performed to said radio terminal, a base transceiver station reflecting a priority of data, The 1st class of service for being a base station device for bidirectional wireless packet communications used with a radio communications system which assigns a transmitter meeting to said radio terminal, reflecting a priority of data which said radio terminal transmits, and transmitting guaranteed-the quality type data.

It is defined by the 2nd class of service for transmitting data which does not guarantee the quality, and as said 1st class of service, A transmission buffer which comprises several transmission queue with which priorities for storing a packet which arrived at said base transceiver station from a wire net according to a class of service of this packet when there are a class which guarantees maximum delay time, and a class which guarantees minimum band width differ.

A statistical-data acquisition means which calculates statistics of quantity of data at a given priority of this data when guaranteed-the quality type data arrives from a wire net, The uphill direction priority management tool which manages a priority of guarantee-of-quality model data which a radio terminal tends to transmit, and quantity of this data for every radio terminal, Get down from a wire net and a ratio of data volume of unit time of the amount of direction guarantee model data and the amount of uphill direction guarantee model data from a radio terminal is calculated, A traffic balance control means to determine the number of times M which goes up to a radio terminal and permits

transmission of data, and the number of times N to a radio terminal which gets down and transmits data, The uphill direction scheduling list which specifies transmission order over a transmit terminal of uphill direction data, A ratio with the amount of going-down data transmission determined by the amount of uphill data transmission determined by said traffic balance control means, and a statistical-data acquisition means, The uphill direction scheduling list making means for creating the uphill direction scheduling list based on the contents of management of said uphill direction priority management tool, A counting means which was performed to the number of times and a radio terminal which went up to said radio terminal and permitted transmission of data and which gets down and calculates the number of times of data transmission, A pointer means which directs cue which gets down while pointing to a radio terminal which is on said uphill direction scheduling list, and permits data transmission of the uphill direction, and takes out a packet at a transmitter meeting of data, A transmission control means to which addressing to a radio terminal gets down and transmits direction data after reaching the number of times M which enumerated data of said counting means go up to a radio terminal, and permits transmission of data, clears a counting means after addressing to a radio terminal getting down and performing data transmission N times, and transmission of uphill direction data is permitted to a radio terminal.

[0016]In claim 1, since it gets down to a transmission buffer and cue at a given priority over data of a direction is prepared, a packet which arrived from a wire net can be stored according to a class of service, and can be managed. A statistical-data acquisition means calculates statistics of quantity of data about guaranteed-the quality type data which arrives from a wire net at a given priority. The uphill direction priority management tool manages a priority of guarantee-of-quality model data which a radio terminal tends to transmit, and quantity of this data by table format for every radio terminal.
[0017]A traffic balance control means determines the number of times N which gets down with the uphill direction, gets down towards the number of times M which searches for a rate of quantity of data traffic with a direction, goes up to a radio terminal, and permits transmission of data, and a radio terminal, and transmits data. The uphill direction scheduling list making means creates the uphill direction scheduling list which gets down with the amount of uphill data transmission, and specifies transmission order over a transmit terminal of uphill direction data based on a rate with the amount of data transmission, and the contents of management of said uphill direction priority management tool.
[0018]A transmission control means goes up by enumerated data of a counting means, it gets down and the number of times of data transmission is grasped, the number of times of a transmission permission of data, and after permitting M going-up data transmission, N going-down data transmission is performed, and M going-up data transmission is permitted after N going-down data transmission (after enumerated data reach M+N). A pointer means directs cue which gets down while pointing to a radio terminal which is on said uphill direction scheduling list, and permits data transmission of the uphill direction, and takes out a packet at a transmitter meeting of data. A position of cue which a radio terminal which permits uphill direction data transmission next time, or next time should get down, and should take out a packet from a state of a pointer means at the time of direction data transmission can be grasped.

[0019]According to claim 1, it becomes possible to offer a guarantee of the going-up direction and communication quality fixed about data communications of both directions getting down. A base station device for bidirectional wireless packet communications of claim 2 this invention, A radio communications system containing a base transceiver station from which data is relayed between a wire net and a wireless communication network, and a radio terminal which is in said base transceiver station and a dependency, and carries out wireless packet communication between said base transceiver stations is characterized by comprising:
The uphill direction scheduling section which manages a data transmission order of a radio terminal that said base transceiver station raised a Request to Send of data.
Data which arrived from a wire net is distributed on a transmission buffer according to a priority, While it has a data transmission part which transmits data taken out from said transmission buffer and said base transceiver station controls data transmission addressed to a radio terminal, and data transmission of a radio terminal by polling, Data transmission is performed to said radio terminal, a base transceiver station reflecting a priority of data, The 1st class of service for being a base station device for bidirectional wireless packet communications used with a radio communications system which assigns a transmitter meeting to said radio terminal, reflecting a priority of data which said radio terminal transmits, and transmitting guaranteed-the quality type data.
It is defined by the 2nd class of service for transmitting data which does not guarantee the quality, and as said 1st class of service, A transmission buffer which comprises several transmission queue with which priorities for storing a packet which arrived at said base transceiver station from a wire net according to a class of service of this packet when there are a class which guarantees maximum delay time, and a class which guarantees minimum band width differ.
A statistical-data acquisition means which calculates statistics of quantity of data at a given priority of this data when guaranteed-the quality type data arrives from a wire net, The uphill direction priority management tool which manages a priority of guarantee-of-quality model data which a radio terminal tends to transmit, and quantity of this data for every radio terminal, Get down from a wire net and a ratio of data volume of unit time of the amount of direction guarantee model data and the amount of uphill direction guarantee model data from a radio terminal is calculated, A traffic balance control means to determine the number of times M which goes up to a radio terminal and permits transmission of data, and the number of times N to a radio terminal which gets down and transmits data, The uphill direction scheduling list which specifies transmission order over a transmit terminal of uphill direction data, A ratio with the amount of going-down data transmission determined by the amount of uphill data transmission determined by said traffic balance control means, and a statistical-data acquisition means, The uphill direction scheduling list making means for creating the uphill direction scheduling list based on the contents of management of said uphill direction priority management tool, A going-up counting means which calculates the number of times which a base transceiver station went up to a radio terminal, and permitted transmission of data, and a going-down counting means which calculates the number of times to which a base transceiver station got down to a radio terminal, and transmitted data, A pointer means which directs cue which gets down while pointing to a radio terminal which is on said uphill direction scheduling list, and permits data transmission of the uphill direction, and takes out a

packet at a transmitter meeting of data, After addressing to a radio terminal getting down, transmitting direction data and addressing to a radio terminal getting down, after going up to a radio terminal and permitting transmission of data, and transmitting direction data, After going up to a radio terminal, permitting transmission of data and reaching enumerated data and a value which it got down and enumerated data of a counting means acquired from said traffic balance control means of said going-up counting means, they are said going-up counting means and a transmission control means which gets down and clears a counting means.

[0020]In claim 2, a transmission buffer, a statistical-data acquisition means, the uphill direction priority management tool, a traffic balance control means, the uphill direction scheduling list, the uphill direction scheduling list making means, a pointer means, and a transmission control means are established like claim 1. Have established independently a going-up counting means which calculates the number of times of a transmission permission of uphill data, and a going-down counting means which gets down and calculates transmission frequency of data, and a transmission control means, after permitting one going-up data transmission -- 1 time -- getting down, performing data transmission, and going up, after [N times] getting down and performing uphill data transmission permission of data transmission and M time -- a counting means -- and it gets down and a counting means is cleared.
[0021]According to claim 2, it becomes possible to offer a guarantee of the going-up direction and communication quality fixed about data communications of both directions getting down. Claim 3 is [this invention] characterized by that a base station device for bidirectional wireless packet communications of claim 1 or claim 2 comprises the following.
The amount calculating means of uphill total traffic which calculates the total data volume of guaranteed-the quality type data which each radio terminal tends to transmit to said uphill direction priority management tool.
An accommodation terminal number control means which controls an addition to an administration object of the uphill direction priority management tool about the new going-up data transmission request from each radio terminal when the total data volume which said amount calculating means of uphill total traffic calculated exceeds a threshold.
An information notification means which notifies information to an applicable radio terminal about the new going-up data transmission request from each radio terminal when it is not able to add to an administration object of the uphill direction priority management tool.

[0022]In claim 3, when the total data volume of uphill guarantee-of-quality type data which each radio terminal tends to transmit exceeds a threshold, an addition to an administration object of the uphill direction priority management tool is controlled about the new going-up data transmission request from each radio terminal. It is reported that a demand was not received to an applicable radio terminal about the new going-up data transmission request from each radio terminal when it was not able to add to an administration object of the uphill direction priority management tool.
[0023]In a base station device for bidirectional wireless packet communications given in

either claim 1, claim 2 and claim 3 claim 4, The 1st radio terminal that is going to transmit zone guarantee type data when said uphill direction scheduling list making means updates the contents of said uphill direction scheduling list, When the 2nd radio terminal that is going to transmit maximum-delay-time guarantee type data is detected, the contents of said uphill direction scheduling list are determined that said 2nd radio terminal has priority over the 1st radio terminal, and will transmit data.
[0024]It comes to be able to carry out the data transmission of the radio terminal which transmits maximum-delay-time guarantee type data compared with a radio terminal which transmits zone guarantee model data by control of a priority at the time of creating the uphill direction scheduling list preferentially in claim 4.
[0025]
[Embodiment of the Invention](A 1st embodiment) One embodiment of the base station device for bidirectional wireless packet communications of this invention is described with reference to drawing 1 - drawing 3. This gestalt corresponds to claim 1 and claim 4.
[0026]Drawing 1 is a block diagram showing the composition of the up-and-down bidirectional scheduling section of this gestalt. Drawing 2 is a flow chart which shows the contents of control of this gestalt. Drawing 3 is a time chart which shows the example of the data transmission and reception of this gestalt. In this gestalt, the transmission buffer, the statistical-data acquisition means, the uphill direction priority management tool, the traffic balance control means, the uphill direction scheduling list, the uphill direction scheduling list making means, the counting means, pointer means, and transmission control means of claim 1, Get down, respectively and The direction transmission buffer 111, the direction statistical-data acquisition part 112 of going down, the uphill direction priority management table 113, the traffic balance acquisition part 114, the uphill direction scheduling list 115, the uphill direction scheduling section 121, the counter 117, the pointer 116. And it corresponds to the transmission control part 130.
[0027]In this gestalt, the case where this invention is applied to the base transceiver station of the radio communications system containing the base transceiver station from which data is relayed between a wire net and a wireless communication network, and the radio terminal which is in said base transceiver station and a dependency, and carries out wireless packet communication between said base transceiver stations is assumed. In this gestalt, the up-and-down bidirectional scheduling section 110 shown in drawing 1 is formed in the base transceiver station.
[0028]About the radio communications system which applies this invention. The 1st class of service for transmitting guaranteed-the quality type data and the 2nd class of service for transmitting the data whose quality is not guaranteed are defined, and the case where there are a class which guarantees maximum delay time as said 1st class of service, and a class which guarantees minimum band width is assumed.
[0029]When a base transceiver station polls among the algorithms specified in the IEEE802.11 committee as radio access control, it assumes following the polling algorithm which controls intensively the opportunity of the data transmission and reception a subordinate's radio terminal. It is as this polling algorithm having been shown in drawing 9 which already explained.
[0030]In the following explanation, it gets down from the data transmission which faces to a radio terminal from a base transceiver station, and is called the data transmission of a direction, and the data transmission which goes to a base transceiver station from a radio

terminal is called the data transmission of the uphill direction. It writes a (VV) mold [the traffic class which guarantees maximum delay time], and it writes the (CL) mold [the traffic class which guarantees minimum band width].
[0031]If drawing 1 is referred to, The bottom of besides bidirectional scheduling section 110 gets down, and The direction transmission buffer 111, the direction statistical-data acquisition part 112 of going down, the uphill direction priority management table 113, the traffic balance acquisition part 114, the uphill direction scheduling list 115, the pointer 116, the counter 117, It has the uphill direction scheduling section 121 and the transmission control part 130. Each arrow shown in drawing 1 shows a control flow.
[0032]It gets down and the direction transmission buffer 111 comprises several cue at which priorities differ mutually. That is, the data packet of a (VV) mold and the data packet of the (CL) mold which differ in a priority are held at mutually different independent cue. It gets down and the direction transmission buffer 111 holds the data which faces to a radio terminal from a base transceiver station and which gets down and is transmitted to a direction at each cue only between the waiting for transmission.
[0033]It gets down and the direction statistical-data acquisition part 112 detects the quantity of the data which got down and reached the direction transmission buffer 111, or the quantity of data which gets down and is held at the direction transmission buffer 111 at a given priority of data. The uphill direction priority management table 113 has managed the information showing the priority of the guaranteed-the quality type data which the radio terminal of the subordinate of a base transceiver station transmits as shown in drawing 1, and the statistic of data volume according to a terminal.
[0034]When there is a demand of polling from a subordinate's radio terminal to a base transceiver station, this uphill direction priority management table 113 registers the information on the demand from that radio terminal, and manages the priority and data volume of data. Per unit time gets down and the traffic balance acquisition part 114 calculates the ratio of the data volume of a direction, and the data volume of the uphill direction as traffic balance. It gets down, and it can get down, the data volume of a direction can be obtained from the direction statistical-data acquisition part 112, and the data volume of the uphill direction can be obtained from the contents of the uphill direction priority management table 113.
[0035]The traffic balance acquisition part 114 determines the number of times M of the polling to a radio terminal, and the number of times N of data transmission addressed to a radio terminal according to the traffic balance for which it asked. The uphill direction scheduling list 115 holds the information which specifies an order of the polling to a radio terminal. That is, the identification information (STA ID) of the radio terminal assigned about each of the transmission order 1, 2, and 3, ..., M as shown in drawing 1 is held. That is, in the example of drawing 1, the schedule of polling is decided to be the turn of a terminal (1), a terminal (2), a terminal (1), ..., a terminal (3).
[0036]The uphill direction scheduling section 121 creates the contents of the uphill direction scheduling list 115 as shown in drawing 1 based on the traffic balance inputted from the contents held at the uphill direction priority management table 113, and the traffic balance acquisition part 114. While the pointer 116 points to the information on any one radio terminal (radio terminal which should be polled next) in the uphill direction scheduling list 115, It gets down and points to any one of two or more of the cue according to priority in the direction transmission buffer 111 (cue which should take out a

packet next).
[0037]About the pointer 116, a direction can be changed to the state of pointing to the uphill direction scheduling list 115, and the state of getting down and pointing to the direction transmission buffer 111. That is, it can be chosen by changing the direction of the pointer 116 whether the uphill direction scheduling list 115 is referred to or it gets down and the direction transmission buffer 111 is referred to.
[0038]The counter 117 calculates the number of times of movement of the pointer 116 (update frequency). The pointer 116 and the counter 117 are controlled by the transmission control part 130. By the traffic balance acquisition part 114, get down with the going-up direction data determined, and the balance (traffic balance) of traffic volume with direction data, It is updated whenever the amount of uphill direction data which gets down and is detected by the direction statistical-data acquisition part 112 and which gets down and becomes settled in the data volume of a direction and the contents of the uphill direction priority management table 113 is updated.
[0039]And if traffic balance is updated, the change will be reflected in the uphill direction scheduling list 115 by the uphill direction scheduling section 121, and will be reflected in operation of the up-and-down bidirectional scheduling section 110. The contents of the control in the up-and-down bidirectional scheduling section 110 are as being shown in drawing 2. Operation of the up-and-down bidirectional scheduling section 110 is explained below, referring to drawing 2.
[0040]Polling execution frequency [which was determined by the traffic balance acquisition part 114] (M) Reach and get down after the start of PCF, and the up-and-down bidirectional scheduling section 110 checks direction data transmission frequency (N), Regulation polling frequency is provided in M and the number of times of regulation going-down data transmission is provided in N (Step S001). In the following step S002, it is investigated whether the present direction which the pointer 116 refers to has pointed out the uphill direction scheduling list 115, or it got down and the direction transmission buffer 111 is pointed out.
[0041]The destination address of the packet concerned is read with reference to the packet which progresses to Step S003 when the pointer 116 has pointed out the uphill direction scheduling list 115, gets down and is in the head of the cue according to priority of the direction transmission buffer 111. In the following step S004, it is investigated whether the terminal of the polling place on the uphill direction scheduling list 115 which the pointer 116 has pointed out, and the destination address of the leading packets referred to at Step S003 are in agreement. That is, it is judged whether according to the polling procedure specified by IEEE802.11, it gets down with polling and data transmission is performed simultaneously.
[0042]When it gets down with the terminal of a polling place and the destination terminal of data is in agreement, it gets down with polling, direction data transmission is simultaneously performed at Step S005, and it progresses to Step S007. In not being in agreement, only polling is transmitted at Step S006 and it progresses to Step S007.
[0043]In order [which expresses with Step S007 the position to which the pointer 116 points] to advance one, the contents of the polling counter (PC) are updated. The contents of the counter 117 are also updated. The following step S008 compares the value Cx of the counter 117, and regulation polling frequency M of Step S001. In being equal, it progresses to S009 from Step S008, and it gets down from the direction of the pointer

116, and returns to Step S002 towards the direction transmission buffer 111.
[0044]On the other hand, when the value Cx of the counter 117 is not equal to regulation polling frequency M, it progresses to Step S010. And it is investigated whether the value Cx of the counter 117 is equal to the sum of regulation polling frequency M and the number of times N of regulation going-down data transmission. It returns from Step S010 to a being [it / (Cx=M+N)] case S001, and regulation polling frequency M and the number of times N of regulation going-down data transmission are determined again. In not being (Cx=M+N), without changing the direction of the pointer 116, it returns to Step S002 and starts a drilling procedure again.
[0045]When the direction of a pointer gets down at Step S002, a direction gets down on the other hand and the direction transmission buffer 111 is pointed out, it progresses to Step S011. And according to a predetermined algorithm, a packet is taken out out of the cue which got down and was prepared according to the priority on the direction transmission buffer 111. In the following step S012, the contents (polling list) of the uphill direction priority management table 113 are referred to. In continuing Step S013, it is identified whether based on the contents of the uphill direction priority management table 113, the destination terminal of the packet taken out at Step S011 is performing the data transmission request of the uphill direction. That is, it is judged whether according to the polling procedure specified by IEEE802.11, data transmission from which it gets down, and polling are performed simultaneously.
[0046]When the destination terminal of the packet taken out at Step S011 is performing the data transmission request of the uphill direction, data transmission from which it gets down at the following step S014, and polling are performed simultaneously, and it progresses to Step S016.
[0047]On the other hand, when the destination terminal of the packet taken out at Step S011 is not performing the data transmission request of the uphill direction, only data transmission from which it progresses to Step S015, and gets down is performed, and it progresses to the following step S016. The value Cx of the counter 117 is updated in Step S016. Continuing Step S017 compares the value Cx of the counter 117 after updating with the number of times N of regulation going-down data transmission specified at Step S001.
[0048]In being (Cx=N), after progressing to Step S018 and changing the direction of the pointer 116 to the uphill direction scheduling list 115, it returns to Step S002. On the other hand, in not being (Cx=N), it progresses to Step S019. And the value Cx of the counter 117 is compared with regulation polling frequency M and the sum with the number of times N of regulation going-down data transmission.
[0049]In being (Cx=M+N), it returns to Step S001 and specifies again regulation polling frequency M and the number of times N of regulation going-down data transmission. In not being (Cx=M+N), without changing the direction of the pointer 116, it returns and gets down to Step S002, and starts the data transmission procedure of a direction again. When carrying out control shown in drawing 2, data as shown in drawing 3 between a base transceiver station and a subordinate's radio terminal can be transmitted and received.
[0050]In drawing 3, "D", "P", and "A" which were written by each signal frame shown with a rectangle express "data", "polling", and "a positive acknowledge (ACK)", respectively. Get down in the example of drawing 3 and at the cue in the direction

transmission buffer 111. Radio terminal (1) Only the data of addressing exists, and the direction of the pointer 116 assumes the case where data is transmitted and received between a base transceiver station and a radio terminal (1-3), when the uphill direction scheduling list 115 is pointed out first.

[0051]The operation shown in drawing 3 is explained below. After a base transceiver station transmits the beacon in which the start of a PCF period is shown, it aligns the pointer 116 with the head of the uphill direction scheduling list 115, and checks the radio terminal (1) which polls first. Then, since it gets down from a base transceiver station and checks that the destination terminal of the packet is a radio terminal (1) with reference to the leading packets in the cue of the direction transmission buffer 111, it gets down with polling to a radio terminal (1), and data transmission is performed simultaneously. Namely, (P+D) is transmitted in the timing of T1.

[0052]In this case, since a radio terminal (1) gets down with polling and the data of a direction is received simultaneously, it gets down and transmission of the ACK frame which is a signal of the reception completion of direction data, and transmission of the going-up direction data to polling are performed simultaneously. Namely, a radio terminal (1) transmits (D+A) in the timing of T2. Then, in a base transceiver station, the one value Cx of the counter 117 is advanced, and also the one pointer 116 is carried forward on the uphill direction scheduling list 115, and the radio terminal for [of the following] polling (2) is checked.

[0053]If it gets down from a base transceiver station and checks that the destination terminal of the packet is not a radio terminal (2) with reference to the leading packets in the cue of the direction transmission buffer 111, ACK frame transmission to the going-up direction data received from the radio terminal (1) after that just before the polling to a radio terminal (2) and polling is performed simultaneously. Namely, a base transceiver station transmits (P+A) in the timing of T3.

[0054]After the polling ("P" of T7) to the radio terminal (3) described by the Mth of the uphill direction scheduling list 115 ends a base transceiver station, It gets down from the uphill direction scheduling list 115, the direction of the pointer 116 is changed into the direction transmission buffer 111, data is picked out from cue, addressing to a radio terminal (1) gets down, and data transmission is started.

[0055]Since the radio terminal (1) exists in the uphill direction priority management table 113 in that case, it gets down and data transmission and polling are performed simultaneously. The ACK frame to the going-up direction data received from the radio terminal (3) in the timing of T8 is transmitted simultaneously. Namely, a base transceiver station transmits (D+P+A) in the timing of T9.

[0056]A radio terminal (1) performs simultaneously transmission of the ACK frame which was received in the timing of T9 and with which it gets down and the reception completion of direction data is expressed, and uphill direction data transmission to polling of the timing of T9. Namely, a radio terminal (1) transmits (D+A) in the timing of T10. and addressing to a radio terminal gets down from a base transceiver station, and data transmission is the number of times of regulation going-down data transmission -- repeat execution is carried out N times.

[0057]By the way, when the uphill direction scheduling section 121 of drawing 1 creates the uphill direction scheduling list 115, it takes into consideration the traffic class about a guarantee of quality of data. That is, when the traffic class (CL) which offers the

guarantee of traffic class (VV) which guarantees maximum delay time, and minimum band width exists, it is determined that the transmission order of the terminal on the uphill direction scheduling list 115 will give priority to the former.

[0058]For example, in the case of drawing 1, the terminal (1, 2) which is going to transmit the data of a VV type priority to the uphill direction priority management table 113, and the terminal (3) which is going to transmit the data of a CL type priority are registered. In this case, priority is given to the terminal (1, 2) which is going to transmit the data of a VV type priority over the terminal (3) which is going to transmit the data of a CL type priority about the transmission order of the uphill direction scheduling list 115 which the uphill direction scheduling section 121 creates.

[0059]That is, like the contents of the uphill direction scheduling list 115 shown in drawing 1, the transmission order about a terminal (1, 2) is arranged previously, and the transmission order about a terminal (3) is arranged behind. Therefore, priority can be given to the terminal which transmits data to be guaranteed [of maximum delay time] over the terminal which transmits data [need / minimum band width / to be guaranteed], and it can transmit data first.

[0060](A 2nd embodiment) Another embodiment of the base station device for bidirectional wireless packet communications of this invention is described with reference to drawing 4 - drawing 6. This gestalt corresponds to claim 2 and claim 4. Drawing 4 is a block diagram showing the composition of the up-and-down bidirectional scheduling section of this gestalt. Drawing 5 is a flow chart which shows the contents of control of this gestalt. Drawing 6 is a time chart which shows the example of the data transmission and reception of this gestalt.

[0061]In this gestalt, the case where this invention is applied to the base transceiver station of the radio communications system containing the base transceiver station from which data is relayed between a wire net and a wireless communication network, and the radio terminal which is in said base transceiver station and a dependency, and carries out wireless packet communication between said base transceiver stations is assumed. In this gestalt, the up-and-down bidirectional scheduling section 110 shown in drawing 4 is formed in the base transceiver station.

[0062]This gestalt is a modification of a 1st embodiment. In drawing 4, drawing 1 and a corresponding element attach the same numerals, and are shown. The following explanation is omitted about the same component as a 1st embodiment, and the same operation. It goes up by this gestalt instead of the counter 117 of drawing 1, and the counter 118 and the going-down counter 119 are formed with it. It is as the contents of control being shown in drawing 5.

[0063]In this gestalt, if the contents of the uphill direction scheduling list 115 are read once, that next will get down and will take out a packet from the direction transmission buffer 111 once. This operation is repeated by turns. The direction to which the pointer 116 points for every renewal of the position of the pointer 116 is changed by turns. About the other operation, it is the same as that of a 1st embodiment.

[0064]The contents of control of this gestalt are explained below, referring to drawing 5. Steps S101-S107 shown in drawing 5 and the contents of S113-S118 are the same as that of the case of drawing 2 except for going up to control of the uphill direction instead of the value Cx of the counter 117, getting down, getting down to control of a direction using the value Cxu of the counter 118, and using the value Cxd of the counter 119.

[0065]When the direction of the pointer 116 has pointed out the uphill direction scheduling list 115, S105 or S106 is performed through S103 and S104 from Step S102. That is, it gets down at Step S105, and data transmission and polling are performed simultaneously, or it only polls at Step S106. The value Cxu of a polling counter (PC) and the going-up counter 118 is updated at Step S107. And it goes up by Step S108, and the value Cxu of the counter 118 is compared with regulation polling frequency M.
[0066]And when the value Cxu of the going-up counter 118 reaches regulation polling frequency M, it progresses and gets down from Step S108 to S109, and the value Cxd of the counter 119 is compared with the number of times N of regulation going-down data transmission. In being (Cxd=N) at Step S109, it returns to Step S101 and resets the going-up counter 118, the going-down counter 119, regulation polling frequency M, and the number of times N of regulation going-down data transmission.
[0067]In not being (Cxd=N) at Step S109, after getting down from direction of the pointer 116 at Step S110 and changing in the direction of the direction transmission buffer 111, it returns to Step S102.
[0068]When it goes up by Step S108 and the value Cxu of the counter 118 has not reached regulation polling frequency M, it gets down at Step S111, and the value Cxd of the counter 119 is compared with the number of times N of regulation going-down data transmission. In not being (Cxd=N) at Step S111, after getting down from direction of the pointer 116 at Step S110 and changing in the direction of the direction transmission buffer 111, it returns to Step S102.
[0069]In being (Cxd=N) at Step S111, it returns to Step S102, turning the direction of the pointer 116 to the uphill direction scheduling list 115 (going up) (** which does not change a direction). On the other hand, when the direction of the pointer 116 gets down at Step S102 and it has turned to the direction transmission buffer 111, it passes along Steps S113-S115, and Step S116 or S117 is performed.
[0070]That is, it gets down at Step S116, and data transmission and polling are performed simultaneously, or it gets down at Step S117, and only data transmission is performed. It gets down at Step S118, the value Cxd of the counter 119 is updated, and Step S119 compares Cxd with the number of times N of regulation going-down data transmission. When it gets down and the value Cxd of the counter 119 reaches the number of times N of regulation going-down data transmission, it goes up by Step S121, and the value Cxu of the counter 118 is compared with regulation polling frequency M.
[0071]In being (Cxu=M) at Step S121, it returns to Step S101 and resets the going-up counter 118, the going-down counter 119, regulation polling frequency M, and the number of times N of regulation going-down data transmission. In not being (Cxu=M) at Step S121, after changing direction of the pointer 116 towards the uphill direction scheduling list 115 at Step S123, it returns to Step S102.
[0072]When Cxd has not reached the number of times N of regulation going-down data transmission at Step S119, it goes up by Step S120, and the value Cxu of the counter 118 is compared with regulation polling frequency M. In not being (Cxu=M) at Step S120, after turning direction of the pointer 116 towards the uphill direction scheduling list 115 at Step S123, it returns to Step S102.
[0073]In being (Cxu=M) at Step S120, it progresses to Step S122, and it returns to Step S102, got down from direction of the pointer 116 and turned in the direction of the direction transmission buffer 111. When carrying out control shown in drawing 5, data as

shown in drawing 6 between a base transceiver station and a subordinate's radio terminal can be transmitted and received. In drawing 6, "D", "P", and "A" which were written by each signal frame shown with a rectangle express "data", "polling", and "a positive acknowledge (ACK)", respectively.

[0074]In the example of drawing 6, a base transceiver station gets down, only the data addressed to a radio terminal (1) exists in the cue in the direction transmission buffer 111, and it assumes that the direction of the first pointer 116 is fit for the uphill direction scheduling list 115. The operation shown in drawing 6 is explained below. First, a base transceiver station transmits the beacon in which the start of a PCF period is shown, and checks the radio terminal (1) which should double the position of the pointer 116 with the head of the uphill direction scheduling list 115, and should poll first after that.

[0075]Then, it gets down from a base transceiver station, and checks that the destination terminal of the packet is a radio terminal (1) with reference to the leading packets in the cue of the direction transmission buffer 111. And it gets down with polling and data transmission is performed simultaneously. Namely, (P+D) is transmitted in the timing of T1. In the radio terminal (1) which receives this, it gets down and transmission of the ACK frame which is a signal of the reception completion of direction data, and uphill direction data transmission to polling are performed simultaneously. Namely, (D+A) is transmitted in the timing of T2.

[0076]Then, it changes in the direction of the direction transmission buffer 111, and it gets down from direction of the pointer 116, addressing to a radio terminal (1) gets down [it gets down data is picked out from the cue of the direction transmission buffer 111,], and a base transceiver station starts data transmission. Since the radio terminal (1) is registered into the uphill direction priority management table 113 in that case, it gets down and a base transceiver station performs data transmission and polling simultaneously. The ACK frame which shows the reception completion of the data received from the radio terminal (1) by T2 also transmits. Namely, a base transceiver station transmits (D+P+A) in the timing of T3.

[0077]In the radio terminal (1) which receives this, it gets down and transmission of the ACK frame which is a signal of the reception completion of direction data, and uphill direction data transmission to polling are performed simultaneously. Namely, (D+A) is transmitted in the timing of T4. Then, a base transceiver station turns direction of the pointer 116 towards the uphill direction scheduling list 115 again, and checks the radio terminal (2) which should be polled next from the contents of the uphill direction scheduling list 115.

[0078]And it gets down from a base transceiver station, and checks that the destination terminal of the packet is not a radio terminal (2) with reference to the leading packets in the cue on the direction transmission buffer 111. Therefore, a base transceiver station performs polling to a radio terminal (2) next. Simultaneously, the ACK frame to the going-up direction data received from the radio terminal (1) in the timing of T4 is transmitted. Namely, (P+A) is transmitted in the timing of T5.

[0079]It is repeated as the same operation as the above-mentioned explanation shows drawing 6 this or subsequent ones. And whenever direction of the pointer 116 performs polling and going-down data transmission once, it is changed. Therefore, the opportunity of the data transmission of the going-up [which faces to a radio terminal from a base transceiver station] direction which goes to a base transceiver station from a radio

terminal with the opportunity of the data transmission of a direction by getting down will occur by turns.

[0080]By the way, when the uphill direction scheduling section 121 of drawing 4 creates the uphill direction scheduling list 115, it takes into consideration the traffic class about a guarantee of quality of data. That is, when the traffic class (CL) which offers the guarantee of traffic class (VV) which guarantees maximum delay time, and minimum band width exists, it is determined that the transmission order of the terminal on the uphill direction scheduling list 115 will give priority to the former.

[0081]For example, in the case of drawing 4, the terminal (1, 2) which is going to transmit the data of a VV type priority to the uphill direction priority management table 113, and the terminal (3) which is going to transmit the data of a CL type priority are registered. In this case, priority is given to the terminal (1, 2) which is going to transmit the data of a VV type priority over the terminal (3) which is going to transmit the data of a CL type priority about the transmission order of the uphill direction scheduling list 115 which the uphill direction scheduling section 121 creates.

[0082]That is, like the contents of the uphill direction scheduling list 115 shown in drawing 4, the transmission order about a terminal (1, 2) is arranged previously, and the transmission order about a terminal (3) is arranged behind. Therefore, priority can be given to the terminal which transmits data to be guaranteed [of maximum delay time] over the terminal which transmits data [need / minimum band width / to be guaranteed], and it can transmit data first.

[0083](A 3rd embodiment) Another embodiment of the base station device for bidirectional wireless packet communications of this invention is described with reference to drawing 7. Drawing 7 is a block diagram showing the composition of the up-and-down bidirectional scheduling section of this gestalt. This gestalt corresponds to claim 3. In this gestalt, the amount calculating means of uphill total traffic, accommodation terminal number control means, and information notification means of claim 3 correspond to the accommodation terminal number restricting part 120.

[0084]This gestalt is a modification of a 2nd embodiment, and in order to control the uphill direction priority management table 113 to be shown in drawing 7, the accommodation terminal number restricting part 120 is added. It is the same as that of a 2nd embodiment except it. Like a 1st embodiment and a 2nd embodiment, when a base transceiver station has the demand of polling from a subordinate's radio terminal, the uphill direction priority management table 113 carries out additional registration of the priority of data and the information on data volume which a radio terminal tends to transmit, and manages them for every terminal.

[0085]The accommodation terminal number restricting part 120 calculates the total data volume of the guaranteed-the quality type data which each radio terminal tends to transmit based on the information registered into the uphill direction priority management table 113. It is investigated whether the data volume which should regulate the total data volume of the called-for guaranteed-the quality type data as compared with the threshold R1 defined beforehand was reached. And when the total data volume of guaranteed-the quality type data exceeds the threshold R1, it prevents that the accommodation terminal number restricting part 120 adds the radio terminal (polling was required) which has newly raised the demand of uphill data transmission to the uphill direction priority management table 113.

[0086]Since the total data volume exceeded the threshold R1, when the radio terminal which has newly raised the uphill data transmission request is not added to the uphill direction priority management table 113, the accommodation terminal number restricting part 120 notifies the information which shows that it was not able to add to an applicable radio terminal.

[0087]

[Effect of the Invention]As mentioned above, a base transceiver station taking into consideration going up and the balance of the traffic volume from which it gets down, and the priority of data according to this invention. Since a subordinate's addressing to a radio terminal can get down and the opportunity of data transmission can be determined as the data transmitter meeting of a subordinate's radio terminal, Even when going up and the traffic from which it gets down have a bias, it becomes possible the going-up direction and to get down, to guarantee maximum delay time and minimum band width to the data communications of a direction, and to guarantee fixed communication quality.

[0088]By regulating the number of radio terminals accommodated in the table which manages the data transmission request of the uphill direction, a base transceiver station can prevent performing scheduling to the radio terminal exceeding the scheduling capability, and can control degradation of the communication quality which should be guaranteed. It becomes possible by carrying out scheduling of the maximum-delay-time guarantee type data flow preferentially to perform packet transmission with a fixed time interval to the data flow. Therefore, data communications, such as a video stream, become possible.